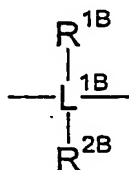


We claim:

1. A monocyclopentadienyl complex which comprises the structural feature of the formula (Cp)(-Z-A)<sub>m</sub>M (I), where the variables have the following meanings:

Cp is a cyclopentadienyl system,

Z is a bridge between A and Cp of the formula,



where

$L^{1B}$  are each, independently of one another, carbon or silicon,

$R^{1B}$  is C<sub>2</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR<sup>3B</sup><sub>3</sub>, where the organic radical R<sup>1B</sup> may also be substituted by halogens and R<sup>1B</sup> and A may also be joined to form a five- or six-membered ring,

$R^{2B}$  is hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR<sup>3B</sup><sub>3</sub>, where the organic radical R<sup>2B</sup> may also be substituted by halogens and R<sup>2B</sup> and A may also be joined to form a five- or six-membered ring,

$R^{3B}$  are each, independently of one another, hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R<sup>3B</sup> may also be joined to form a five- or six-membered ring,

A is an unsubstituted, substituted or fused, heteroaromatic ring system,

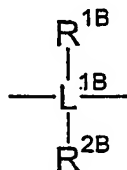
M is a metal selected from the group consisting of titanium in the oxidation state 3, vanadium, chromium, molybdenum and tungsten and

m is 1, 2 or 3.

2. A monocyclopentadienyl complex as claimed in claim 1 having the formula (Cp)-  
 (-Z-A)<sub>m</sub>MX<sub>k</sub> (VI), where the variables have the following meanings:

Cp is a cyclopentadienyl system,

Z is a bridge between A and Cp of the formula,



where

L<sup>1B</sup> are each, independently of one another, carbon or silicon,

R<sup>1B</sup> is C<sub>2</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR<sup>3B</sup><sub>3</sub>, where the organic radical R<sup>1B</sup> may also be substituted by halogens and R<sup>1B</sup> and A may also be joined to form a five- or six-membered ring,

R<sup>2B</sup> is hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR<sup>3B</sup><sub>3</sub>, where the organic radical R<sup>2B</sup> may also be substituted by halogens and R<sup>2B</sup> and A may also be joined to form a five- or six-membered ring,

R<sup>3B</sup> are each, independently of one another, hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R<sup>3B</sup> may also be joined to form a five- or six-membered ring,

A is an unsubstituted, substituted or fused, heteroaromatic ring system,

M is a metal selected from the group consisting of titanium in the oxidation state 3, vanadium, chromium, molybdenum and tungsten,

m is 1, 2 or 3,

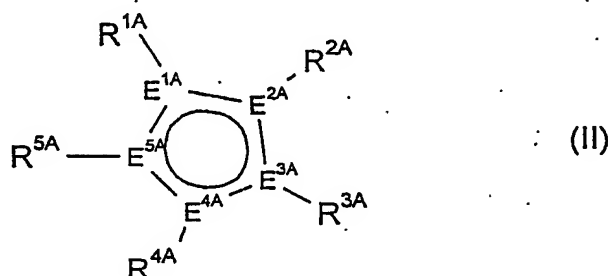
X are each, independently of one another, fluorine, chlorine, bromine, iodine, hydrogen, C<sub>1</sub>-C<sub>10</sub>-alkyl, C<sub>2</sub>-C<sub>10</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having 1-10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, NR<sup>1</sup>R<sup>2</sup>, OR<sup>1</sup>, SR<sup>1</sup>, SO<sub>3</sub>R<sup>1</sup>, OC(O)R<sup>1</sup>, CN, SCN, β-diketonate, CO, BF<sub>4</sub><sup>-</sup>, PF<sub>6</sub><sup>-</sup> or a bulky noncoordinating anion,

R<sup>1</sup>-R<sup>2</sup> are each, independently of one another, hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR<sup>3</sup><sub>3</sub>, where the organic radicals R<sup>1</sup>-R<sup>2</sup> may also be substituted by halogens and two radicals R<sup>1</sup>-R<sup>2</sup> may also be joined to form a five- or six-membered ring,

R<sup>3</sup> are each, independently of one another, hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R<sup>3</sup> may also be joined to form a five- or six-membered ring and

k is 1, 2, or 3.

3. A monocyclopentadienyl complex as claimed in claim 1 or 2, wherein the cyclopentadienyl system Cp has the formula (II):



where the variables have the following meanings:

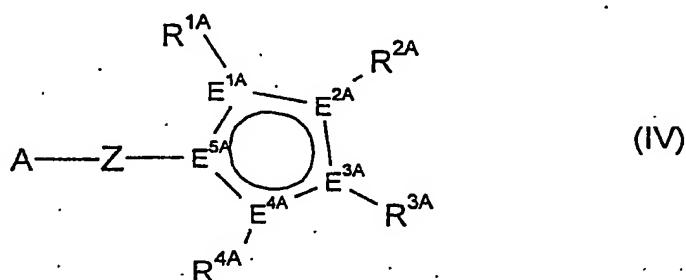
E<sup>1A</sup>-E<sup>5A</sup> are each carbon or not more than one E<sup>1A</sup> to E<sup>5A</sup> is phosphorus,

R<sup>1A</sup>-R<sup>5A</sup> are each, independently of one another, hydrogen, C<sub>1</sub>-C<sub>20</sub>-alkyl, C<sub>2</sub>-C<sub>20</sub>-alkenyl, C<sub>6</sub>-C<sub>20</sub>-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part, NR<sup>6A</sup><sub>2</sub>, N(SiR<sup>6A</sup><sub>3</sub>)<sub>2</sub>, OR<sup>6A</sup>, OSiR<sup>6A</sup><sub>3</sub>, SiR<sup>6A</sup><sub>3</sub>, BR<sup>6A</sup><sub>2</sub>, where the organic radicals R<sup>1A</sup>-R<sup>5A</sup> may also be substituted by halogens and two vicinal radicals R<sup>1A</sup>-R<sup>5A</sup> may also be joined to form a five- or six-membered ring, and/or two vicinal radicals R<sup>1A</sup>-R<sup>5A</sup> are joined to form a heterocycle which contains at least one atom

from the group consisting of N, P, O and S, with 1, 2 or 3 substituents  $R^{1A}$ - $R^{5A}$  each being a -Z-A group and

$R^{6A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals  $R^{6A}$  may also be joined to form a five- or six-membered ring.

4. A monocyclopentadienyl complex as claimed in any of claims 1 to 3, wherein the cyclopentadienyl system Cp together with -Z-A has the formula (IV):



where the variables have the following meanings:

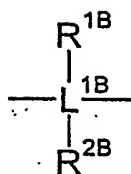
$E^{1A}$ - $E^{5A}$  are each carbon or not more than one  $E^{1A}$  to  $E^{5A}$  is phosphorus,

$R^{1A}$ - $R^{4A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part,  $NR^{6A}_2$ ,  $N(SiR^{6A}_3)_2$ ,  $OR^{6A}$ ,  $OSiR^{6A}_3$ ,  $SiR^{6A}_3$ , where the organic radicals  $R^{1A}$ - $R^{4A}$  may also be substituted by halogens and two vicinal radicals  $R^{1A}$ - $R^{4A}$  may also be joined to form a five- or six-membered ring, and/or two vicinal radicals  $R^{1A}$ - $R^{4A}$  are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O and S,

$R^{6A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals  $R^{6A}$  may also be joined to form a five- or six-membered ring,

A is an unsubstituted, substituted or fused, heteroaromatic ring system,

Z is a bridge between A and Cp of the formula,



5

where

$L^{1B}$  are each, independently of one another, carbon or silicon,

10

$R^{1B}$  is  $C_2$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or  $SiR^{3B}_3$ , where the organic radical  $R^{1B}$  may also be substituted by halogens and  $R^{1B}$  and A may also be joined to form a five- or six-membered ring,

15

$R^{2B}$  is hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or  $SiR^{3B}_3$ , where the organic radical  $R^{2B}$  may also be substituted by halogens and  $R^{2B}$  and A may also be joined to form a five- or six-membered ring,

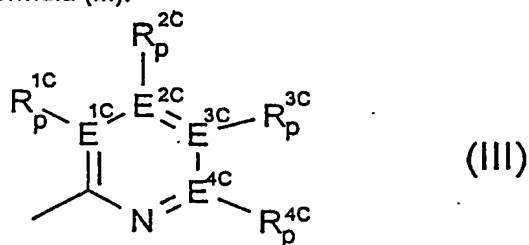
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$R^{3B}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals  $R^{3B}$  may also be joined to form a five- or six-membered ring.

25

5. A monocyclopentadienyl complex as claimed in any of claims 1 to 4, wherein A has the formula (III):

30



35

where

$E^{1C}$ - $E^{4C}$  are each carbon or nitrogen,

$R^{1C}$ - $R^{4C}$

are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or  $SiR^{5C}_3$ , where the

40

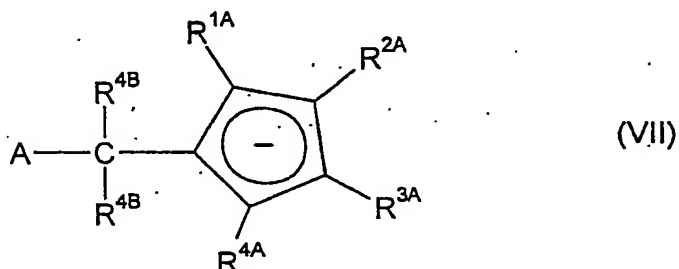
organic radicals  $R^{1C}$ - $R^{4C}$  may also be substituted by halogens or nitrogen or further  $C_1$ - $C_{20}$ -alkyl groups,  $C_2$ - $C_{20}$ -alkenyl groups,  $C_6$ - $C_{20}$ -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or  $SiR^{5C}_3$  and two vicinal radicals  $R^{1C}$ - $R^{4C}$  or  $R^{1C}$  and Z may also be joined to form a five- or six-membered ring,

$R^{5C}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals  $R^{5C}$  may also be joined to form a five- or six-membered ring and

p is 0 when  $E^{1C}$ - $E^{4C}$  is nitrogen and is 1 when  $E^{1C}$ - $E^{4C}$  is carbon.

15. 6. A monocyclopentadienyl complex as claimed in any of claims 1 to 5, wherein  $L^{1B}$  is carbon.
7. A monocyclopentadienyl complex as claimed in any of claims 1 to 6, wherein Z is  $-CH(C_6H_5)-$ .
20. 8. A catalyst system for olefin polymerization comprising
  - A) at least one monocyclopentadienyl complex as claimed in any of claims 1 to 7,
  25. B) optionally an organic or inorganic support,
  - C) optionally one or more activating compounds,
  - D) optionally one or more catalysts suitable for olefin polymerization and
  30. E) optionally one or more metal compounds containing a metal of group 1, 2 or 13 of the Periodic Table.
9. A prepolymerized catalyst system comprising a catalyst system as claimed in claim 8 and one or more linear  $C_2$ - $C_{10}$ -1-alkenes polymerized onto it in a mass ratio of from 1:0.1 to 1:1 000, based on the catalyst system.
35. 10. The use of a catalyst system as claimed in claim 8 or 9 for the polymerization or copolymerization of olefins.

11. A process for preparing polyolefins by polymerization or copolymerization of olefins in the presence of a catalyst system as claimed in claim 8 or 9.
12. A process for preparing cyclopentadienyl system anions of the formula (VII),



where the variables have the following meanings:

15  $R^{1A}$ - $R^{4A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part,  $NR^{6A}_2$ ,  $N(SiR^{6A}_3)_2$ ,  $OR^{6A}$ ,  $OSiR^{6A}_3$ ,  $SiR^{6A}_3$  where the organic radicals  $R^{1A}$ - $R^{4A}$  may also be substituted by halogens and two vicinal radicals  $R^{1A}$ - $R^{4A}$  may also be joined to form a five- or six-membered ring, and/or two vicinal radicals  $R^{1A}$ - $R^{4A}$  are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O and S,

20

$R^{6A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals  $R^{6A}$  may also be joined to form a five- or six-membered ring,

25

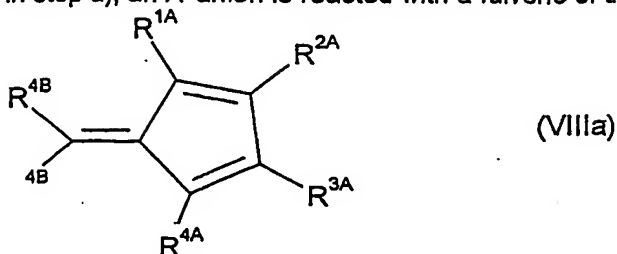
A is an unsubstituted, substituted or fused, heteroaromatic ring system,

30  $R^{4B}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or  $SiR^{3B}_3$ , where the organic radicals  $R^{4B}$  may also be substituted by halogens and two geminal or vicinal radicals  $R^{4B}$  may also be joined to form a five- or six-membered ring and

35  $R^{3B}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals  $R^{3B}$  may also be joined to form a five- or six-membered ring,

40 which comprises the step a) or a'), where,

in step a), an  $A^-$  anion is reacted with a fulvene of the formula (VIIIa)



or,

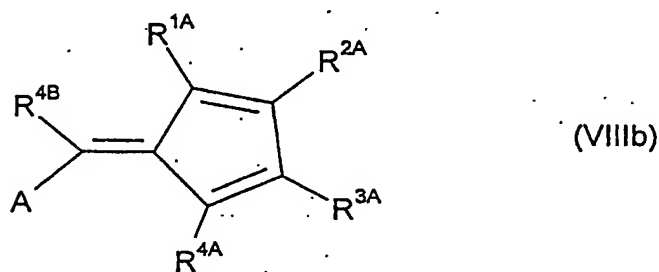
in step a'), an organometallic compound  $R^{4B}M^BX^B$ , where

$M^B$  is a metal of group 1 or 2 of the Periodic Table of the Elements,

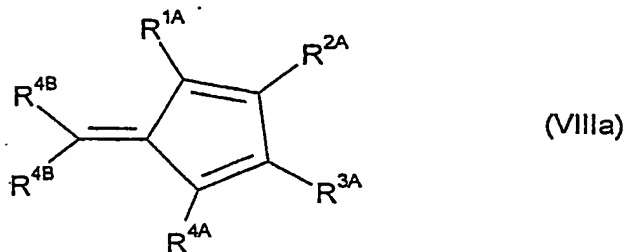
$X^B$  is halogen,  $C_1-C_{10}$ -alkyl, alkoxy having from 1 to 20 carbon atoms in the alkyl radical and/or from 6 to 20 carbon atoms in the aryl radical, or  $R^{2B}$  and

b is 0, when  $M^B$  is a metal of group 1 of the Periodic Table of the Elements and is 1 when  $M^B$  is a metal of group 2 of the Periodic Table of the Elements,

is reacted with a fulvene of the formula (VIIIb):



13. A process for preparing cyclopentadiene systems of the formula (VIIa)



where the variables have the following meanings:

$E^{6A}-E^{10A}$  are each carbon, where in each case four adjacent  $E^{6A}-E^{10A}$  form a conjugated diene system and the remaining  $E^{6A}-E^{10A}$  additionally bears a hydrogen atom,



$R^{1A}$ - $R^{4A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part,  $NR^{6A}_2$ ,  $N(SiR^{6A}_3)_2$ ,  $OR^{6A}$ ,  $OSiR^{6A}_3$ ,  $SiR^{6A}_3$ , where the organic radicals  $R^{1A}$ - $R^{4A}$  may also be substituted by halogens and two vicinal radicals  $R^{1A}$ - $R^{4A}$  may also be joined to form a five- or six-membered ring, and/or two vicinal radicals  $R^{1A}$ - $R^{4A}$  are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O and S,

$R^{6A}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals  $R^{6A}$  may also be joined to form a five- or six-membered ring,

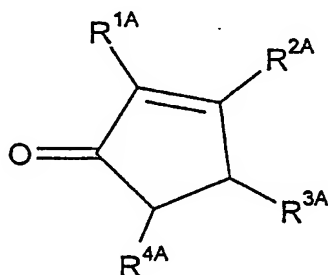
A is an unsubstituted, substituted or fused, heteroaromatic ring system,

$R^{2B}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or  $SiR^{3B}_3$ , where the organic radicals  $R^{2B}$  may also be substituted by halogens and  $R^{2B}$  and A may also be joined to form a five- or six-membered ring,

$R^{3B}$  are each, independently of one another, hydrogen,  $C_1$ - $C_{20}$ -alkyl,  $C_2$ - $C_{20}$ -alkenyl,  $C_6$ - $C_{20}$ -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals  $R^{3B}$  may also be joined to form a five- or six-membered ring,

which comprises the following step:

a") reaction of an  $A-CR^{2B}R^{2B-}$  anion with a cyclopentenone system of the formula (IX)



(IX)